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A note on scattering of electrons by atomic nucleus

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Abstract : The proper radial wave function has been derived for the scattering of electrons from a bare nucleus. The asymptotic form of the total radial wave function required for evaluating scattering cross section has been computed with rigorous mathematical analysis. Point-like behaviour of scattering from nucleus at low and high energies has been pointed out.

Keyword : Elastic electron scattering, radial wave function, asymptotic form.

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The scattering of electrons involving atomic nuclei and charged particles are of great interest in physics.

In the present problem, for example, the scattering of electrons by a bare nucleus has been considered. Let us assume that the energy of the incident electrons is sufficient to penetrate the electron-cloud surrounding the nucleus. An electron moving towards a nucleus experiences mostly the Coulomb-field around the nuclear region. The more energetic electron may either be scattered from the vicinity of the nuclear region or it may pass on through the nucleons and then get scattered.

The interaction potential outside the charged nuclear sphere is purely Coulombic and inside the nuclear sphere Coulomb field is modified. The effect of modification may be taken into account by a certain parameter a.

The wave function may be taken as [1]

$$U = \frac{1}{r} \sum_{l=0}^{\infty} c_l g_l (r) P_l (\cos\theta), \tag{1}$$

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